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CLAIMS[Claim(s)]

[Claim 1] The 1st npn form transistor turned on when an electrical signal is inputted. The 2nd npn form transistor turned off when said electrical signal is inputted. Current is outputted when said 2nd npn form transistor turns off, while said 1st npn form transistor turns on. A pair of pnp form transistors which intercept the output of said current when said 2nd npn form transistor turns on, while said 1st npn form transistor turns off. The current compensation circuit which compensates the standup of said output current when said 2nd npn form transistor is OFF, and compensates falling of said output current when said 2nd npn form transistor is ON. The light emitting element drive circuit characterized by having the light emitting element which emits light based on the input of said output current compensated by this current compensation circuit.

[Claim 2] The resistance by which said current compensation circuit was established in the collector side of said 2nd npn form transistor. The light emitting element drive circuit according to claim 1 characterized by compensating said output current with the differential current which consists of a capacitor formed between said collector and the input side of said light emitting element and internal resistance of said light emitting element, and is formed of the time constant by said resistance, a capacitor, and internal resistance.

DETAILED DESCRIPTION[Detailed Description of the Invention][0001]

[Field of the Invention] This invention relates to the semiconductor laser driving circuit used for the optical sending circuit of optical-communication equipment, for example.

[0002]

[Description of the Prior Art] Generally there is a circuit as shown below, for example as a semiconductor laser driving circuit used for an optical sending circuit. The buffer circuit which reverses and outputs the level of the electrical signal at the same time it outputs the electrical signal of an input as it is. The 1st and the 2nd npn form transistor which are turned on when the level of the output electrical signal of a buffer circuit is high-level. The current generator prepared in the emitter side of the 1st and 2nd npn form transistors. The laser diode prepared between the 1st npn form transistor and grounding. In the semiconductor laser driving circuit which consists of photo diode formed between the APC circuits connected to the anode of a laser diode, and a grounding node and a grounding current generator, when the 1st npn form transistor turns on, a laser diode emits light according to negative constant current.

[0003] Moreover, there is a semiconductor laser driving circuit using the current Miller circuit which consists of a pair of pnp form transistors as other circuits. The buffer circuit as the above where this is the same, the 1st and the 2nd npn form transistor. The current generator prepared between groundings the emitter side of the 1st and 2nd npn form transistors. The current Miller circuit which consists of a pair of pnp transistors which flow when the 1st npn form transistor turns on, and output positive current to a laser diode. When it consists of photo diode formed between the APC circuits connected to the cathode of a laser diode, and a grounding node and a grounding current generator and the 1st npn form transistor turns on, a pair of pnp form transistors turn on, and a laser diode is made to emit light.

[0004]

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[Problem to be solved by the invention] by the way, "the analog integrated-circuit engineering first volume for a VLSI" (the gray / MEIYA collaboration --) of literature ***** Supervision of translation, Baifukan, September 10, 1991, the 4th ** of the first edition as clearly written in 70 pages - the 154th page of the 2nd **** When the high-speed performance of a general transistor is observed, an integrated circuit / device simple substance is not asked, but the pnp form transistor has structure unsuitable for high-speed operation as compared with the npn form transistor. Therefore, as a circuit which attains high-speed optical communication, the semiconductor laser driving circuit using the npn form transistor which cannot attain improvement in the speed but drives a laser diode directly with a negative power supply like the former was adopted in the latter circuit.

[0005]

[Means for solving problem] The 1st npn form transistor which turns on the light emitting element drive circuit concerning this invention when an electrical signal is inputted. The 2nd npn form transistor turned off when said electrical signal is inputted. Current is outputted when said 2nd npn form transistor turns off, while said 1st npn form transistor turns on. A pair of pnp form transistors which intercept the output of said current when said 2nd npn form transistor turns on, while said 1st npn form transistor turns off. The current compensation circuit which compensates the standup of said output current when said 2nd npn form transistor is OFF, and compensates falling of said output current when said 2nd npn form transistor is ON. It has the light emitting element which emits light based on the input of said output current compensated by the current compensation circuit.

[0006] In this invention, if an electrical signal is inputted into a light emitting element drive circuit, while the 1st npn form transistor turns on, the 2nd npn form transistor turns off, and a pair of pnp form transistors flow by ON of the 1st npn form transistor, and output current. At this time, a current compensation circuit compensates the standup of that output current, therefore a light emitting element emits light by the compensated standup of current in an instant. Moreover, since the 2nd npn form transistor turns on while the 1st npn form transistor turns off when the input of an electrical signal is severed, a pair of pnp form transistors mentioned above will be in an OFF state, and intercept the output of current. At this time, a current compensation circuit compensates falling of that output current, and quenches a light emitting element in an instant based on falling of the compensated current.

[0007]

[Mode for carrying out the invention] The circuit diagram in which drawing 1 shows the operation form of this invention, and

drawing 2 are the wave form charts for explaining operation of the circuit diagram. The buffer circuit which reverses and outputs the level of the electrical signal in drawing at the same time 1 outputs the electrical signal of an input as it is. The 1st and the 2nd npn form transistor which are turned on when Q1 and Q2 have the high-level level of the output electrical signal of the buffer circuit 1. The current generator prepared between groundings the emitter side of the 1st and 2nd npn form transistors and 2 are a pair of pnp form transistors Q3, and the current Miller circuit which consists of Q4. Each emitter is connected to a power supply Vcc, if the 2nd npn form transistor Q2 turns off while the 1st npn form transistor Q1 turns on, it will be in switch-on, and it is Current io from the collector of the pnp form transistor Q4. It outputs.

[0008] LD is the internal resistance Rs. It is the laser diode which it has, and an anode is connected to the collector of the pnp form transistor Q4, and the cathode is connected to the earth side. PD is photo diode and an anode is connected to the earth side. APC which a cathode compensates for the big temperature characteristic (drive current value pair optical output power) of a laser diode LD and a laser diode LD (Automatic Power Control) It connects with the current generator I side through the circuit 3.

[0009] Rp It is speedup resistance, and one end is connected to the collector of the 2nd npn form transistor Q2, and the other end is connected to the power supply Vcc side. Cp It is a speedup capacitor, and one end is connected to the collector of the 2nd npn form transistor Q2, and the other end is connected to the anode of a laser diode LD. In addition, the speedup resistance Rp mentioned above and the speedup capacitor Cp And internal resistance Rs of a laser diode LD The current

compensation circuit of this invention is constituted and it is the speedup resistance R_p . A value is the internal resistance R_s of a laser diode LD. It is set up greatly enough.

[0010] Next, operation is explained, referring to the wave form chart of drawing 2. If an electrical signal changes from a low level high-level, while the buffer circuit 1 outputs a high-level electrical signal to the 1st npn form transistor Q1 and turns it on, the electrical signal which reversed the level of the signal is outputted to the 2nd npn form transistor Q2, and is turned off. At this time, the pnp form transistor Q3 of current Miller circuit 2 and Q4 will be in switch-on by ON of the 1st npn form transistor Q1, and it is Current i_o from the collector of the pnp form transistor Q4. It is outputted. This current i_o As shown in

drawing 2 (b), since the pnp form transistor Q3 and the response of Q4 are slow, start slowly, and [a subsequent wave] The stray capacity [in / on the time of electrical signal high level, and / the node of the collector of a laser diode LD and the pnp form transistor Q4] C, and internal resistance R_s of a laser diode LD It is formed of a time constant.

[0011] On the other hand, when the 2nd npn form transistor Q2 turns off, it is current i_d from a power supply V_{cc} (tr). Speedup resistance R_p It minds and is the speedup capacitor C_p . It passes and is said output current i_o . It flows into a laser diode LD. This current i_d (tr) Speedup capacitor C_p Passage is an instant. It is the speedup capacitor C_p in the passage of time. It is [in / in order to charge / the time of electrical signal high level] the speedup resistance R_p . And internal resistance R_s The sum and speedup capacitor C_p Based on a time constant, it descends gradually, and is differential current i_d (tr). It forms. At this time, a laser diode LD is differential current i_d (tr). The compensated output current i_d (tr) Light is emitted in an instant and the output of that light becomes a wave as shown in

drawing 2 R>

2 (d) at the time of electrical signal high level.

[0012] If an electrical signal changes from high level to a low level, while the buffer circuit 1 outputs a low-level electrical signal to the 1st npn form transistor Q1 and turns it off, the electrical signal which reversed the level of the signal is outputted to the 2nd npn form transistor Q2, and is turned on, this time -- the 1st npn form transistor Q1 -- since said a pair of pnp form transistors Q3 and Q4 become off more off -- current i_o from the pnp form transistor Q4 It is intercepted. Current i_o at this time As mentioned above, they are the stray capacity C and the internal resistance R_s of a laser diode LD. Based on a time constant, it begins (refer to

drawing 2 (b)) to fall slowly.

[0013] On the other hand, when the 2nd npn form transistor Q2 turns on, it is the speedup capacitor C_p . The charged charge is discharged to the 2nd npn form transistor Q2 side with the stray capacity C. The discharge at this time is the speedup resistance R_p of the parallel formed of ON of the 2nd npn form transistor Q2. And internal resistance R_s The sum and speedup capacitor C_p It is discharge based on a time constant, and becomes negative differential current i_d (t f). Therefore, a laser diode LD is quenched while the level of an electrical signal becomes a low.

[0014] When making a laser diode LD emit light in this operation form, it is the output current i_o of current Miller circuit 2. Positive differential current i_d (tr) It compensates. When carrying out quenching, it is said output current i_o . Negative differential current i_d (tf) since it was made to compensate Even if it uses the pnp form transistor Q3 with a slow speed of response, and current Miller circuit 2 which consists of Q4, compared with the former, there are luminescence and an effect that quenching can be carried out in an instant, about a laser diode LD (refer to

drawing 2 (d)).

[0015] In addition, with this operation form, although illustrated using a laser diode LD as a light emitting element, it may replace with it and LED may be used. Moreover, it cannot be overemphasized that it can use for the sending circuit at large which supplies and drives constant current not only to optical communication but to a load, and transmits a signal.

[0016]

[Effect of the Invention] [according to this invention / a circuit] as mentioned above since a current compensation circuit compensates the standup and falling of the output current of a pair of pnp form transistors, respectively Even if it uses a pnp form transistor with a slow speed of response for a light

emitting element drive circuit, luminescence and the effect that quenching can be carried out are acquired in the light emitting element in an instant.